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Building a Child's Brain
How the Brain Grows

Slide One/Day One
You Have Your Orders!
The brain begins by changing from general cells into specialized cells. There are around 30,000 "receipes" in the genetic code that will tell the body how to build itself.

Slide Two-As the body develops, it first forms into three distinct layers that will later form into tissue/organ systems.
Early Brain Formation

- The neural plate lines up like a long worm forming the base of the brain and spinal cord. "After formation of the neural plate, this structure folds at the lateral edges to form the neural groove, which then fuses at its dorsal extreme to create the neural tube, in a process called neurulation. (Fig. 3.1)." p. 33.
- The plate then roles into a tube and closes at both ends as a skeleton develops around the sheath. "The cells of the organizer region proliferate and migrate to form the axial mesoderm underlying the tissues that will constitute the forebrain, and the noto-chord, which underlies tissue that will give rise to the mid-brain, hindbrain and spinal cord." p.32

Slide Three- Inside Out- The brain starts out as a neural plate, then becomes a neural crest, rolls into a tube, then grows from the inside out.

Slide Four-Neurons-These are the basic building blocks of the brain that will form networks in the brain. Experience wires the circuits.

Slide Five-Lock and Key-Brain cells rely on chemicals called neurotransmitters to send messages to each other. If the molecules do not precisely fit into "binding sites" then the chemicals will not have an effect on the target cell.

Slide Six-Synaptic Activity

- Around 50 identified neurotransmitters - neuromodulators.
- Isolates systems within the brain.
- Learning involves a physical change of the cell with the growth of new synapses, alteration in number of chemical receptor sites, changes in neurotransmitter production, and an overall reshaping of the brain cell.

Slide Seven-Functional Circuitry-Brain cells form "functional circuits in the brain" that are utilized when we solve problems in our environment like avoiding predators or finding a mate or filling out our taxes.

Slide Eight-Key Point The Nature/Nurture controversy is a scientifically dead argument.

Slide Nine-Environmental Influences- Genes build the brain, experience shapes the circuits, then can trigger a response from the genes. When genes "express" themselves, the brain changes.

Slide Ten-Neurodevelopmental Genes- Many genes control how the brain builds itself. These genes control the timetables of "neurogenesis, synaptogenesis, plasticity and pruning within the growing brain.

Slide Eleven-Key Point
Genes build the brain across the lifespan and experience wires the circuits.The nature and timing of the environmental stimulation make a difference.

Slide Twelve- Systems of Systems of….. The brain uses different chemicals and cellular structures to form discrete pathways through the brain.

Slide Thirteen-Levels of Structure (In order to understand the brain, the following "levels of structure" must be examined.)

- Cellular
  - Synaptic
  - Electro-chemical
- Developmental
- Global
- How these levels integrate

Slide Fourteen-Prenatal Period-During this period of brain development, brain cells grow at the rate of a quarter of a million per minute.

Slide Fifteen- Extrogestation- Our brains are amazingly immature at birth due to the "pelvic bottleneck" as a result of upright walking. Thus, nature gave us a great deal of brain development occurring outside of the womb within the first five years of life to get around this "design constraint".

Slide Sixteen- Birth- Because of extrogestation, the brain's interior architecture is a work in progress.

Slide Seventeen-Ecological Model (Expanded upon U. Broffenbrenner's model).

- Child
- Parents
- Grandparents & extended family
- Culture
- Technological and social change
- Genes

Slide Eighteen-Delayed Maturation- By age 3 the brain is 90% of its adult weight and will continue to develop well into the third decade of life.

Slide Nineteen-Mapping the Mind-Using modern brain scans, scientists are devising "maps" of the brain.

Slide Twenty-Energy Requirements of the Growing Brain

- In humans, the brain's requirements for growth and development are substantial compared to other organisms.
- 60% of the body's metabolism goes to the brain in the first year of life. (Brain growth patterns in the first year of life are fetal).

Attachment

Slide Twenty-one-Experience Shapes Circuits-Early experiences largely define how the brain "sees the world," not in terms of colors and shapes, but through the lens of autonomic activation.

Slide Twenty-two- Stable Circuits Through Stimulation-The brain wires through stimulation. This stimulation can be either positive or negative.

Slide Twenty-three-Sensitive (Critical) Periods-Researchers from U.C. Berkely discovered in their work with cats that there are times in which the brain is open to stimulation, and in the absence of this stimulation, will not work. This has profound implications for sensory processing.

Slide Twenty-four-Synaptic Activity-Studies on the growing brain indicate that the brain is using an incredible amount of the total metabolism in order to "grow" the brain during the early years of life.

Slide Twenty –Five-Effects Of Abuse and Neglect-Neuroimaing studies of Romanian orphans revealed that early exposure to trauma or neglect can leave noticeable physical traces on how the brain works. These effects show up on PET scans and were initially confused with Alzheimer's disease.

Slide Twenty-six-Architecture of the Mind-Steven Mithrin from the U.K. has researched how the brain in our species integrates information from other "modules". Like an old cathedral, the construction of the human brain takes generations to accomplish.

Slide Twenty-seven-Parents- Parenting matters! Why? You inheret the genes that will build your brain from your parents. A family history of manic-depression or schitzophrenia will show up in the brain development of subsequent generations as the genes for these disorders express themselves. Thus, not only "bad parenting habits" but also phenotype make a difference.

Slide Twenty-eight-Lateralization-The brain's two hemispheres utilize the principle of a "division of labor." Although the majority of the research was with a limited population sample, the research was compelling enough to draw some basic conclusions about the role of the left hemisphere in language and the right hemisphere in spatial processing. The presenter also discussed how we must beware of making too broad of generalizations about the "most complicated structure in the known universe."

Slide Twenty-nine- Parents- Research into parenting practices revealed three basic types. **Authoritarian-** The "My way or the highway" form of parenting is not good for brain development and produces children who are passive and fearful in adulthood. Parents that are **Liaise-Faire** or "Whatever you want dear" makes for angry, resentful and demanding adults. Those that practice consistent limits, backed up with love and using the "discipline as an opportunity to teach is practicing **Authoritative** parenting.

Slide Thirty-Diagnostic & Statistical Manual of Mental Disorders (DSM IV)- Outlines how therapist assess individuals within the family structure and use this instrument to guide treatment.

Slide Thirty-one-The Brain is the Most Complex Structure In The Known Universe.

Slide Thirty-two-Extended Family (Multigenerational) -The Effects of Love-Discussed how the longitudinal commitment of caregivers can help overcome the effects of early childhood trauma-but not reverse them entirely.

Slide Thirty-three- When the Mind Bends (Reviewed how everyday stress can cause a decrease in functioning.

- Phase of Life Difficulties
- Adjustment Disorders

Slide Thirty-Four-When the Mind Twists (Discussed how genetic and environmental factors combine to lead to serious mental illness).

- Conduct Disorders
- Personality Disorders
- Post Traumatic Stress Disorder
- Major Depression
- Manic Depression

Slide Thirty-Five-When the Mind Snaps (Outlined how lifelong medical conditions such as the following disorders require longitudinal management and can have dramatic implications for parenting young children.)

- Psychotic Disorders
- Delusional Disorders
- Schizophrenia

•Dementia

Slide Thirty-Six-Describing Global Functioning-Discussed how mental health professionals rate how a person functions in multiple realms of life (social, vocational, interpersonal, etc.)

Slide Thirty-Seven-Effects of Head Trauma-Discussed how blows to the head can alter personality, cognitive functioning, impulse control, sensory processing and a host of other maladies.

Slide Thirty-Eight-Schizophrenia- Brain imaging devices are homing in on how this extremely serious disorder operates.

Slide Thirty-Nine-Average Developmental Progression-Discussed how people grow, change and adapt to stress. Compared the "baseline" as an average-but not "normal" progression and computed the effects of early trauma on global functioning.

Slide Forty-Mental Disorders & The Next Generation

•Family systems therapist Murray Bowen identified a multi-generational transmission process of trauma.
Multigenerational
Transmission of Trauma

Slide Forty-one- Crime, 1875
The Jukes, a Study in Crime, Pauperism, Disease, and Heredity by English-born sociologist Richard Louis Dugdale, 33, purports to be an extensive criminal-genealogical study of 7 generations of a depraved U.S. family descended from a mid-18th century Dutch tavern keeper. A functionary of the Prison Association of New York, Dugdale has plowed through arrest records and interviewed prisoners, wardens, and inmates of asylums and poorhouses. He concludes that the Jukes have cost the public $1.3 million and that their immorality is hereditary.

Microsoft chronology, 1995

Slide Forty-two-Effects of Therapy – Medical imaging displays changes in brain functioning as a result of therapy.

•It reminds you to focus on things that seem "out of order".
•It is closely associated with the amygdala.
•OCD.

Slide Forty-three- Outcomes (Rand Report) Reviewed the results of the Rand report, "The Cost Benefit Analysis of Early Intervention"

•Perry Preschool Project (Head Start) demonstrated positive outcomes in the areas of:

•Cognitive/Emotional Development-Measurable ↑ in I.Q. (Significant short and mixed long term).

•Education- ↑ academic achievement, ↓ in use of special education, ↑ high school graduation.

•Economic Well-Being- ↓ crime; ↑ income; ↓ welfare participation.

Bottom line: $ 1 early intervention = $ 7 social serv.